which is not yet sufficiently rigid to resist. The result is that phenomena resembling lunar craters are produced. These craters, therefore, are not the result of ejections resembling volcanic eruptions from within, but are the results of action from without. Further than this, the matter carried into the body of the moon will in its turn be melted in the heated interior; consequently the thin crust will no longer be able to support the internal pressure, and rents or fissures of the hardened exterior will take place, and this is the cause of the bright streaks or radiations which can readily be seen on the most superficial examination of the moon. It might be urged in opposition to this view that the molten matter ejected from the interior must soon cool, and not only destroy the traces of the meteoric bombardment, but would also thicken the crust and tend to prevent the penetration of fresh meteors. If one asks why the earth or Mars does not show similar signs of precipitated matter, Dr. Meyer is ready with his answer. By the time that the greater mass of a planet had sufficiently cooled, all the larger débris, the results of the original collision, had been absorbed, and the smaller masses either fell upon the stiffening crust without penetrating it, or were volatilised by friction with the atmosphere, which in those days, it is suggested, was more dense than at present. And if anyone, still unconvinced, asks how it is that Jupiter, for example, can drink up all the matter in a cosmical ring extending into indefinite space, and yet refuses to swallow the small mouthful which in the form of the fifth satellite tantalisingly tempts its capacious appetite, the answer is, wait. All the satellites will eventually be drawn in and form an integral portion of their respective primaries, just as these in their turn will be absorbed in the sun, to be followed again at immense intervals of time by the crashing together of defunct suns producing a larger set of planets with a larger and hotter sun, a solar system on a vaster scale than that in which we play our little part. And so growing in grandeur but diminishing in number, the final catastrophe will come, when there are no more suns to produce collisions, and one huge body cooled to the zero of space, void of available energy, will mark the final outcome of cosmical motion.

This, if we understand our author, is the final state of rest, but there are qualifications introduced which may modify this conclusion. We have endeavoured to draw the conclusion without entering into the limitations which depend, more or less, "in unsern unvollendeten Geist." The only objection one might urge is to the insistence on the lowering of the temperature of the mass to that of the absolute zero. It is only necessary for a uniform temperature, however great, to exist throughout the whole, when a practically useless state of kinetic energy would result, and no work would be possible.

On this world, however formed, it is necessary to introduce life, and, if possible, without a definite creative act implying a breach of continuity. Dr. Meyer follows, but without acknowledgment so far as we have seen, the hypothesis of Helmholtz or of Kelvin. We imagine that the author regards life as old as matter itself, and that its transition from a defunct world to a new one is effected by means of germs, borne through space on fragments; or so-called meteors, and whenever such germs meet with a favourable environment the processes of life are continued. In a collision, heat would be generated only in proportion as motion is destroyed, so that, as the author is careful to point out, fragments could escape without any great development of heat or necessary destruction of all forms of life. But we do not understand so clearly his theory of the method by which the meteoric fragment, carrying life to a new world, finds itself deposited there. But this is of little consequence, since meteors do come here, and if their surface is heated by friction, the interior can be of lower temperature. Or it can very well happen that germs lying on the surface would be blown away in the highest and most attenuated strata of the earth's atmosphere before the fragment reached the denser parts of the gaseous mass, where the compression becomes great enough to generate considerable heat. The author, however, seems to think it necessary to give to the meteor the same velocity as that of the earth, so that it is quietly and gently deposited on the surface without any arrest of motion and therefore without any increase of temperature. Indeed, he seems to think that meteors, bringing with them enormous masses of water, can accompany the earth for some days in its journey round the sun, giving rise to severe local storms, and marvels that meteorologists have not entertained such explanations as legitimate and worthy of consideration. It is true that the author does not say that these meteors are moving in a circular orbit, but he allows this to be inferred, since parabolic velocities do not seem to be considered. We gather from an account that the author gives of a controversy with Dr. Palisa that that astronomer has had some difficulty in following Dr. Meyer's views, and, so far as we can follow the account from the description of one of the disputants, we would respectfully associate ourselves with the opinion of Dr. Palisa.

We have dwelt, perhaps, at too great length on the points of difference that separate us from the author, and have no space to enter on other matters, which we would do the more willingly since no note of disapprobation need accompany our remarks. In many respects, the book is very interesting, and many chapters can be read with equal pleasure and profit, though the connection with terrestrial catastrophes is not very apparent. Dr. Meyer has selected a subject of great interest, but one on which diverse views can be maintained more or less legitimately. He can write pleasantly and clearly, and while his book may be instructive to the general reader, for he studiously avoids all technical expressions, it should not be offensive to the most orthodox theologian.

ARTIFICIAL MINERAL WATERS.

The Evolution of Artificial Mineral Waters. By William Kirkby, F.L.S. Pp. x + 155. (Manchester: Jewsbury and Brown, 1902.) Price 3*s.* 6*d.*

THIS little book has been written with the object of showing the origin and development of the mineral water industry, an industry the commercial importance of which may be to some extent gauged by the author's statement that our annual exports amount to more than

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one million dozens and that, directly or indirectly, it gives employment to no less than 25,000 persons in London alone.

In his historical sketch of the evolution of artificial mineral waters as we know them to-day, the author shows that progress has been made along two main lines. The existence of these popular beverages undoubtedly had its origin in the desire of the earlier physicians to prepare by artificial means saline solutions which should have the same therapeutic and curative effects as the waters obtained from well-known natural springs such as those of Epsom, Seidlitz or Bath. This necessarily involved some knowledge of the chemical nature of their constituents, and it was not, therefore, until Boyle had given birth to analytical chemistry, and Bergman had brought his genius and industry to bear upon the chemical examination of the waters from many of the mineral springs, that such imitation became possible. At the same time, much speculation was being indulged in as to the exact nature of that wonderful "principle" which gave to many of the natural waters their sparkling character and piquant flavour; and the numerous researches which were being made in this direction culminated in the great discovery by Black of the chemical identity and true nature of carbonic acid gas. Along both these lines the author traces the gradual development of the mineral water industry, showing in true perspective and with due attention to their relative importance the various discoveries or steps by which its present position has been reached. In this connection, we think that the author has attached rather too much importance to Brownrigg's share in the discovery of the true nature of carbonic acid gas, and has perhaps given too little prominence to the masterly researches and brilliant deductions of Black. In the main, however, the chapters dealing with the work of the earlier discoverers are accurately and clearly written, and the book should certainly be read by all who are desirous of acquiring an intelligent knowledge of the beginnings and development of this now important industry.

There are, unfortunately, a few blemishes which ought scarcely to have escaped the author's notice. Thus we are told on p. 3 that the latter half of the eighteenth century witnessed the birth of chemistry, while on p. 13 that honour is assigned to the seventeenth. Whether we are to consider the former, the latter, or, indeed, either of these statements correct will naturally depend upon the precise meaning we are to give to the word "birth," but we presume that the author had in his mind the eighteenth century, which witnessed the labours of Black, Cavendish, Priestley, Scheele and Lavoisier, to mention only some of the giants who laid the foundation on which the wonderful superstructure of modern chemistry has been reared.

The statement on p. 34 that "it is possible to-day to obtain by mechanical and other means water of as great chemical and bacterial purity as any natural water from the deep springs" presumably refers to filtration, but is not by any means clear. On p. 67 we are told that Macquer purified carbonic acid by passing it through a vessel "containing lime and water," but are not told how much of the gas passed through. In connection with the use of sodium bicarbonate for the preparation of carbonic acid gas, the author makes, on p. 120, the truly astonishing statement that precautions have to be taken to prevent any *ammonia* present as an impurity *from passing over with the gas into the gas holders*. We should have thought, as a matter of fact, that the presence of the acid used for its decomposition would have constituted a sufficient "precaution." In one or two places, the language is a little involved, and there are several misprints and slips, such as Becheri for Becher on p. 42, Thiloria for Thilorier on p. 60, and *unabsorbed* would have been better than *unattached* on p. 120. The chapter on the syphon and its development is well written, and like the rest of the book is clearly illustrated by means of well-executed drawings. The author states in his prefatory remarks that he does not intend this to be a manufacturer's handbook, and that therefore he has given no formulæ for the preparation of the various waters. For the same reason, presumably, the description of manufacturing processes and machinery is contained within the limits necessary to render the book acceptable to the general reader. It contains a good index and a well-compiled bibliographical table, and we can, in conclusion, heartily commend it "to all whom it may concern." We cannot, however, help feeling that the author would have done well to have given his book a more independent character by dwelling with rather less emphasis on the excellence of the plant and manufactured products of a particular firm.

A. C. C.

DEVELOPMENT OF THE HUMAN EMBRYO

Human Embryology and Morphology. By Dr. A. Keith. Pp. viii + 324. (London: Edward Arnold, 1902.) Price 12*s*. 6*d*. net.

DR. KEITH is an accomplished anatomist, and in this morphological study of the development of the human embryo he has given us a valuable account, the result of wide and exact personal observation, of all the later phases of organogeny.

The descriptions of the changes that occur during the formation of the face and neck, the alimentary tract, the central nervous system, the heart and blood-vessels, the history of the development of the skeleton and musculature of the head and trunk, are evidently the work of one who is thoroughly familiar with the anatomy, not merely of the human subject, but of the apes and other mammals as well; and in what we may term the "anatomical embryology" here set before us there is much which will be of permanent scientific worth, apart from what is of practical importance for the ordinary surgeon.

From the other aspects, however, we regret that this treatise is less satisfactory. The earnest student who expects to find here a critical exposition of the thorny problems of modern embryology, or even a sufficiently accurate statement of the facts, will be sadly disappointed.

The account of the formation of the germinal layers and of the early changes in the mammalian blastocyst is not only inadequate, it is erroneous; we are told, for instance (p. 89), that "in lower vertebrates the mesoblast is entirely produced from the hypoblast," and (p. 243)

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